TYPES OF ARITHMETIC NEEDED IN CERTAIN TYPES OF SALESMANSHIP

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The investigation here reported was undertaken in an attempt to gain a reliable index of the type of arithmetic needed by the clerk in selling goods and by the consuming public in purchasing goods. The problem consists in the analysis of 4,661 bills of sale, representing a total value of $41,560.67, from three large stores in the city of Seattle, Washington—a wholesale and retail hardware store, a department store, and a wholesale and retail grocery store. Table I shows the distribution of the bills and their value.

TABLE I

NUMBER OF BILLS OF SALE AND THEIR VALUE

	Number of Bills	Value
Hardware store	978	$21,330.15
Department store	3,477	18,144.16
Grocery store	206	2,086.36
Total	4,661	$41,560.67

The bills from the hardware store represent the total sales for three consecutive days; the bills from the department store, the "cash delivery" sales for seven consecutive days; the bills from the grocery store, a random selection from the files in which accounts are kept.

METHOD

In analyzing these bills of sale, everything was considered a problem which involved any calculation. The problem might involve multiplying the number of articles purchased by the price, as two dozen shovels at $8.50 per dozen, or it might consist in finding the total sum from the itemized cost of the articles. Items involving fractions or discounts often consisted of more than one

problem. To illustrate, one item of a bill was "75 lbs. wire at $5.05 cwt." The problem involved might be worked by multiplying $5.05 by 75 and pointing off two places, making one problem in multiplication (a three-place number multiplied by a two-place number); or the problem might be solved by multiplying $5.05 by 3 and dividing the result by 4, thus making two distinct problems (a three-place number multiplied by a one-place number, and a four-place number divided by a one-place number); or it might be solved by dividing $5.05 by 2 and the result by 2 and adding the quotients, making two problems in division (a three-place number divided by a one-place number in each case) and one problem in addition (three-place numbers with two addends). There were few items permitting as many solutions as the one just cited. In all such cases the easiest solution was arbitrarily selected, unless the computations on the bill indicated that some other method had been followed. When a bill involved copying but no actual arithmetical operations, e.g., "1 doz. dust pans @ $1.15 doz. . . . . $1.15," it was not counted as a problem and hence is not considered in the final results.

RESULTS

Analysis of addition problems.—The results of analyzing the addition problems taken from the bills of sale from the hardware store show that the most common of these problems involve only three-place or four-place numbers. The problems were tabulated according to the largest number of places which occurred in any addend. Thus, "497 three-place numbers to be added" might be interpreted to mean all addends consist of numbers with three places or that some of the addends contain numbers with three places and other addends contain numbers with one or two places. The surprising thing about the results shown in Table II is the lack of problems having as many as five places in the numbers to be added.

Table III shows that the problems in addition involved in the bills from the hardware store usually contain but two, three, or four addends. However, it is noted that eighty-eight problems have from eleven to fifteen addends, thirty-four problems from

sixteen to twenty addends, and fifteen problems have over twenty addends.

Table IV presents a more detailed analysis of the data secured from the department and grocery stores. These data indicate, as do the distributions shown in Tables II and III, that the most common problems in addition contain three-place numbers with only two addends. In general, the clerk will be called upon to

TABLE II

DISTRIBUTION OF PROBLEMS IN ADDITION FROM THE HARDWARE STORE ACCORDING TO THE LARGEST NUMBER OF PLACES IN ANY ADDEND

Number of Places	Number of Problems
One	16
Two	136
Three	497
Four	310
Five	26

TABLE III

DISTRIBUTION OF PROBLEMS IN ADDITION FROM HARDWARE STORE ACCORDING TO THE NUMBER OF ADDENDS INVOLVED

Number of Addends	Number of Problems	Number of Addends	Number of Problems
Two	366	Eight	28
Three	199	Nine	25
Four	104	Ten	19
Five	57	Eleven to fifteen	88
Six	46	Sixteen to twenty	34
Seven	29	Over twenty	15

add more three-place numbers than any other type. This table also reveals several problems with from ten to eighteen addends, a tendency more marked in the hardware and grocery store bills.

Analysis of subtraction problems.—Table V shows that most of the problems in subtraction involve three-place or four-place numbers. No problem is recorded as including numbers of more than five places. It is interesting to note that subtraction is used but once in the 206 bills of sale from the grocery store. This is due to the fact that in this store the clerk makes out and totals the bill but a central cashier receives the money and makes change.

TABLE IV

DISTRIBUTION OF PROBLEMS IN ADDITION FROM THE DEPARTMENT STORE AND GROCERY STORE BILLS ACCORDING TO THE NUMBER OF PLACES IN THE ADDENDS AND THE NUMBER OF ADDENDS

Highest Number of Places	Department Store	Grocery Store	Total
Two:			
Two addends	91	11	102
Three addends	21	0	21
Four addends	9	4	13
Five addends	4	1	5
Six addends	9	2	11
Seven addends	3	0	3
Eight addends	1	0	1
Nine addends	0	1	1
Ten addends	0	2	2
Eleven addends	1	0	1
Three:			
Two addends	311	70	381
Three addends	67	22	87
Four addends	17	11	28
Five addends	10	4	14
Six addends	4	2	6
Seven addends	4	8	12
Eight addends	4	3	7
Nine addends	1	6	7
Ten addends	3	2	5
Eleven addends	2	3	5
Twelve addends	1	1	2
Thirteen addends	0	2	2
Fifteen addends	0	1	1
Sixteen addends	0	2	2
Seventeen addends	0	4	4
Four:			
Two addends	31	7	38
Three addends	11	6	17
Four addends	2	1	3
Five addends	0	2	2
Six addends	0	3	3
Seven addends	1	2	3
Eight addends	0	1	1
Nine addends	1	1	2
Ten addends	0	1	1
Eleven addends	0	1	1
Twelve addends	0	1	1
Fifteen addends	0	1	1
Sixteen addends	0	1	1
Seventeen addends	0	3	3
Five:			
Eighteen addends	0	2	2

Analysis of multiplication problems.—Table VI shows that most of the problems in multiplication have one-, two-, or three-place numbers multiplied by one-, two-, three-, or four-place numbers.

A vast majority of the multiplication problems can be reduced to the form of a two-place or three-place number multiplied by a one-place or two-place number. The process reverses the multiplier and the multiplicand as indicated in the table, but this is usually done in actual life. For example, if a customer buys three pen

TABLE V

DISTRIBUTION OF PROBLEMS IN SUBTRACTION ACCORDING TO THE LARGEST NUMBER OF PLACES IN THE MINUEND

Number of Places in Minuend	Hardware Store	Department Store	Grocery Store	Total
Two	130	155	0	285
Three	640	1,412	1	2,053
Four	205	756	0	961
Five	11	4	0	15

TABLE VI

DISTRIBUTION OF PROBLEMS IN MULTIPLICATION ACCORDING TO THE NUMBER OF PLACES IN THE MULTIPLICAND AND MULTIPLIER

Problem	Hardware Store	Department Store	Grocery Store	Total
1×1	9	2	0	11
1×2	447	562	330	1,339
1×3	659	197	41	897
1×4	58	2	0	60
1×5	1	0	0	1
2×2	410	130	85	625
2×3	824	59	6	889
2×4	241	22	0	263
2×5	2	0	0	2
3×3	91	0	0	91
3×4	23	0	1	24
5×2	6	0	0	6

knives at $1.25 each, the problem might be listed as a one-place number multiplied by a three-place number, but usually we think of multiplying $1.25 by 3. This problem would thus be classified as involving the multiplication of a three-place number by a one-place number. Notwithstanding the method of interpreting the number of places in the multiplicand and multiplier, it seems clear that a very small amount of multiplication is involved in the buying or selling of goods at these stores.

Analysis of division problems.—Table VII is ample evidence that division is used even less than multiplication. By far the most common problems in division involve either two or three places in the divisor and in the dividend. The relatively few problems in division in comparison with the number in addition and multiplication is very striking. It is also noted that almost all of the division problems are taken from the bills of sale from the hardware store. This is probably due to different practices in marking and selling goods. Many hardware commodities are priced in lots, as "per dozen," "per gross," "per cwt.," etc., but may be sold in broken

TABLE VII

DISTRIBUTION OF PROBLEMS IN DIVISION ACCORDING TO THE HIGHEST NUMBER OF PLACES IN EITHER DIVIDEND OR DIVISOR

Problem	Hardware Store	Department Store	Grocery Store	Total
1÷1	1	3	1	5
1÷2	37	16	13	66
1÷3	35	0	0	35
2÷2	64	4	4	72
2÷3	223	0	0	223
2÷4	3	0	0	3
3÷3	202	0	1	203
3÷4	47	0	0	47
4÷4	2	0	0	2

lots at the regular fractional rate. Many commodities in the department and grocery stores are priced at so much per article or per number of articles and are sold on either basis or on a combination of both. To illustrate, at the hardware store an individual purchases one-half dozen cow chains at $2.75 per dozen and pays $1.38. This indicates that the price per dozen was divided by 2. At the department store an individual buys eight linen collars, priced 25 cents each or $1.40 for a half-dozen, and pays $1.90. This indicates that he pays for six of his collars at the half-dozen rate and for 2 of them at the rate per article. In making the suggested transaction at the hardware store division is involved, but in making the department-store purchase the result is obtained by multiplying 25 cents by 2 and adding the product to $1.40. Some articles in the hardware store are sold on the same basis as

those in the department store, while in a few instances the practice in the department store is the same as in the hardware store. In the grocery store, the practice of pricing at so much per article or per number of articles is almost universal. Such a practice eliminates the necessity for the process of divison, shortens and simplifies the method of computation, and reduces the possibility of error.

Analysis of problems involving fractions.—Table VIII exhibits the nature of the problems in multiplication which involve the use of fractions in their solutions. The first column shows that only those fractions are used whose denominators are 2, 3, 4, 5, 6, 9, 10, 12, 16, 24, and 144. The last column shows that the most commonly used fractions are halves, fourths, twelfths, and sixths. Twelfths are used frequently because the dozen is the unit in the sale of many articles in the hardware business. For instance, wholesale customers buy so many dozens or so many twelfth parts of a dozen articles. At times the fractional part of a dozen is not reduced to its lowest terms but is expressed as $\frac{2}{12}$ or $\frac{10}{12}$. Comparisons indicate extensive use of fractions in the hardware store and little use of them in the grocery store.

It should be added that the use of fractions is necessitated because of the quantity of goods bought rather than on account of the price at which the goods are sold. One of the managers of the department store concerned says that the day is gone when goods can be purchased at $8\frac{1}{3}$ cents a pound or $33\frac{1}{3}$ cents a yard and that at present goods are marked in whole numbers and to a great extent in units of the decimal system. Thus, instead of $8\frac{1}{3}$ cents a pound, the selling price is likely to be either 5 cents or 10 cents, and instead of $33\frac{1}{3}$ cents a yard, the price is likely to be either 30 cents or 35 cents. This practice reduces greatly the use of fractions in computing the selling price of goods and is in keeping with the long-established custom of not selling goods in abnormal and unreasonable fractional portions such as a third of a pound or a ninth of a yard.

But even with these tendencies at work, Table VIII gives considerable evidence that much practice should be given in multiplying two-, three-, and four-place numbers by the commonly used simple fractions and also in multiplying two-, three-, and four-

TABLE VIII

DISTRIBUTION OF PROBLEMS INVOLVING MULTIPLICATION OF FRACTIONS ACCORDING TO THE NUMBER OF PLACES IN THE MULTIPLICAND AND THE NUMBER OF PLACES AND THE PARTICULAR FRACTION IN THE MULTIPLIER

Multiplier	Multiplicand												Total
	One Place			Two Places			Three Places			Four Places			
	H.S.	D.S.	G.S.	H.S.	D.S.	G.S.	H.S.	D.S.	G.S.	H.S.	D.S.	G.S.	
2/144	0	0	0	0	0	0	2	0	0	0	0	0	2
1/24	0	0	0	0	0	0	3	0	0	2	0	0	5
1/20	0	0	0	0	0	0	0	0	0	2	0	0	2
1/12	0	0	0	6	0	0	147	0	0	116	0	0	269
1/10	0	0	0	0	0	0	7	0	0	11	0	0	18
1/8	0	0	0	5	1	0	0	2	0	1	0	0	9
1/6	0	0	0	10	0	0	140	7	0	69	0	0	226
2/12	0	0	0	0	0	0	1	0	0	0	0	0	1
1/5	0	0	0	0	0	0	0	0	0	1	0	0	1
1/4	0	0	0	21	7	0	141	7	2	72	0	0	250
1/3	0	0	0	7	1	0	40	11	0	21	0	0	80
5/12	0	0	0	1	0	0	6	1	0	1	0	0	9
3/8	0	0	0	0	0	0	0	1	0	0	0	0	1
1/2	1	0	0	43	19	9	333	56	25	63	1	1	551
2/12	0	0	0	0	0	0	1	0	0	1	0	0	2
3/5	0	0	0	0	0	0	0	0	0	1	0	0	1
5/8	0	0	0	0	2	0	0	0	0	0	0	0	2
2/3	0	0	0	0	1	0	6	2	0	3	0	0	12
3/4	0	0	0	3	13	0	4	5	0	3	0	0	28
5/16	0	0	0	1	0	0	0	0	0	0	0	0	1
7/8	0	0	0	0	3	0	0	0	0	0	0	0	3
10/12	0	0	0	0	0	0	2	0	0	0	0	0	2
11/12	0	0	0	1	0	0	0	0	0	0	0	0	1
15/16	0	0	0	0	2	0	0	0	0	0	0	0	2
One place:													
1/8	0	0	0	0	6	0	0	0	0	0	0	0	6
1/4	0	0	0	4	46	4	0	12	1	0	0	0	67
1/3	0	0	0	2	14	1	1	1	0	0	0	0	19
3/8	0	0	0	0	2	0	0	0	0	0	0	0	2
4/9	0	0	0	1	1	0	0	0	0	0	0	0	2
1/2	1	4	0	23	129	18	9	29	1	2	0	0	216
5/9	0	0	0	1	1	0	0	0	0	0	0	0	2
5/8	0	0	0	0	1	0	0	0	0	0	0	0	1
2/3	0	0	0	1	9	0	2	3	0	0	0	0	15
3/4	1	0	0	5	23	5	1	7	0	0	0	0	42
7/8	0	0	0	2	3	1	2	0	0	1	0	0	9
11/12	0	0	0	0	0	0	0	0	0	1	0	0	1
Two places:													
1/8	0	0	0	1	1	0	0	0	0	0	0	0	2
1/6	0	0	0	0	0	0	0	0	0	1	0	0	1
1/4	6	0	0	16	3	0	1	0	0	1	0	0	27
1/3	2	2	0	2	1	0	12	0	0	1	0	0	20
1/2	24	30	3	60	21	19	15	4	4	9	0	0	189
7/12	0	0	0	0	0	0	1	0	0	0	0	0	1
2/3	0	0	0	0	2	0	0	0	0	0	0	0	2
3/4	5	0	0	7	1	2	2	0	0	0	0	0	17
11/12	0	0	0	0	0	0	3	0	0	1	0	0	4

TABLE VIII—*Continued*

Multiplier	Multiplicand												Total
	One Place			Two Places			Three Places			Four Places			
	H.S.	D.S.	G.S.	H.S.	D.S.	G.S.	H.S.	D.S.	G.S.	H.S.	D.S.	G.S.	
Three places:													
1/4	0	0	0	0	0	0	1	0	0	0	0	0	1
1/2	0	0	0	0	0	0	1	0	1	0	0	0	2
7/12.........	0	0	0	0	0	0	0	0	0	1	0	0	1
2/3	0	0	0	0	0	0	1	0	0	1	0	0	2
Four places:													
1/3	0	0	0	0	0	0	0	0	0	1	0	0	1
Five places:													
2/3	0	0	0	0	0	0	0	0	0	1	0	0	1

place numbers by mixed numbers with one, two, and three places and the commonly used simple fractions.

While this investigation shows that many multiplications involving simple fractions are made, it does not show much use of fractions in the other fundamental operations. There are just a few instances of addition of fractions, e.g., $4\frac{2}{3}+4\frac{1}{3}$ or $1\frac{1}{2}+\frac{1}{4}+\frac{3}{4}$, but such cases are so rare that no tabulation of them is made. Likewise there is no demand for subtraction of fractions, for the selling price of each item is determined separately and does not involve the use of fractions. All cases involving division of fractions might well be treated as special cases of multiplication of fractions, but the problems which represent what are called problems in division of fractions are recorded separately. In the enumeration of them the whole numbers represent the number of places in the dividends and divisors respectively and the fractions represent the actual fractions in the respective dividends or divisors. The problems are: $3\div3-\frac{1}{4}$, $3\div1-\frac{2}{3}$, $2+\frac{7}{12}\div3$, $3+\frac{2}{3}\div3$, $2+\frac{1}{2}\div3$, $2+\frac{1}{12}\div3$, $4+\frac{1}{3}\div3$, $3\div3+\frac{1}{2}$, $3\div1+\frac{1}{2}$, and $3\div2+\frac{1}{6}$. These problems are all very simple, and the fractions are the same as those commonly used in multiplication. The possible reason assigned for little use of addition and subtraction of fractions will probably account for the little use of division of fractions.

It seems evident that a definite knowledge of how to multiply simple fractions is absolutely essential in successful salesmanship of the type under consideration and that if the purchaser is to

protect his own interests it is equally important for him to have this same ability.

Analysis of denominate numbers.—The importance of fractions is emphasized by an analysis of the use of denominate numbers. Denominate numbers as such, i.e., reduction from one denomination to another, are not used at all in the transactions involved, but suitable units of measure such as dozen, yard, pound, foot, inch, bale, pair, etc., and fractional portions or multiples of these units are extensively used. Tables IX, X, XI, and XII make this clear. Table IX shows that the dozen is used especially in the hardware store and that the amount purchased is expressed in terms of the dozen and not in terms of lower units.

TABLE IX

REFERENCE TO THE DOZEN AS A UNIT

Number of Dozen	Hardware Store	Department Store	Grocery Store	Total
1/12	351	0	0	351
1/6	206	1	0	207
2/12	1	0	0	1
1/4	229	0	0	229
1/3	61	4	0	65
5/12	8	0	0	8
1/2	413	36	0	449
7/12	2	0	0	2
5/6	2	0	0	2
10/12	2	0	0	2
1 to 5	638	17	60	715
Over 5	19	0	5	24

TABLE X

REFERENCE TO THE GROSS AS A UNIT

Number of Gross	Hardware Store
1/24	4
1/6	23
1/4	9
1/3	8
1/2	5
50/144	2
5/12	1
7/12	1
1 to 5	135
Over 5	7

Table X illustrates the tendency to express quantities sold in terms of a particular unit, the gross. No attempt is made to reduce the fractional portions of the gross to dozens.

Table XI emphasizes the same thing with regard to the yard, and here again no attempt is made to express the amounts purchased in terms other than yards and fractional portions thereof. Table

TABLE XI

REFERENCE TO THE YARD AS A UNIT

Number of Yards	Hardware Store	Department Store
1/8	0	2
1/6	0	3
1/4	0	12
1/3	0	8
3/8	0	1
5/12	0	1
1/2	0	31
5/8	0	2
2/3	0	1
3/4	1	18
7/8	0	4
1 to 5	3	517
6 to 10	0	141
10 to 20	0	81

TABLE XII

REFERENCE TO THE FOOT AS A UNIT

Number of Feet	Hardware Store	Department Store
1 to 5	8	3
6 to 15	10	8
16 to 50	35	4
50 to 100	30	1
Over 100	25	0

XII gives ample evidence that no reduction to higher denominations is made when the foot is the unit of measure. Any attempt to reduce an amount between 50 and 100 feet in length to yards and feet, or to rods, yards, and feet, as might easily be inferred from the table for linear measure, would be uneconomical and ridiculous.

Similar evidence can be offered in the use of the pound, gallon, inch, ton, or barrel, but the mere statement that in each instance

the practice is to express the amount in fractional or multiple portions of the particular unit under consideration is sufficient. No more attempt is made to reduce these units to higher or lower denominations than is made in the use of keg, box, pan, bench, case, hundred, or thousand.

Analysis of rates of discount.—The rates of discount from the bills of sale from the hardware store are exhibited in Table XIII. This list is much more extended than one would expect and includes many rates such as 2, 23, 28 per cent, etc., which do not conform to the basic tens nor to usual fractional parts of 100. The ten most common rates of discount according to the frequency of their

TABLE XIII

DISTRIBUTION OF RATES OF DISCOUNT

Percentage of Discount	Hardware Store	Percentage of Discount	Hardware Store	Percentage of Discount	Hardware Store
2	2	30	42	56	2
5	112	32	1	60	2
7½	6	33⅓	13	61	1
10	134	35	39	65	15
12½	11	40	57	66	1
15	17	43	1	70	38
20	22	45	20	75	63
23	1	50	90	80	2
25	38	51	1	85	13
28	2	55	45	87	1

use are 10, 5, 50, 75, 40, 55, 30, 35, 25, and 70 per cent. On one occasion the amount of discount is expressed as "one-third off," but in all other cases the rate is expressed in terms of percentage.

Such a wide array of percentages is probably due to the influence of the wholesale trade, as discount is rarely indicated in the retail sales. Since this is true, the knowledge of percentage needed to figure the discounts may be regarded as a specialized knowledge, required only by the hardware clerks who may be called upon to sell goods at wholesale, or by the customers who are buying at wholesale. If these bills are typical, neither the clerk in the department store or grocery store nor the general public, the ultimate consumers of the goods purchased, need have an extended knowledge of percentage. However, no sweeping conclusions should be drawn until investigations involving other lines of business have been made.

The reader no doubt has been impressed by the fact that very little use of arithmetic is demanded of the clerks selling the goods itemized on these bills of sale or of the purchasing public. The little use made of arithmetic in the purchase of goods becomes all the more vivid when it is realized that 945 of the 4,661 bills of sale examined require no computation at all, merely a statement of the quantity and the listed price, e.g., "100 pounds of sugar @ $12.00 cwt." These bills indicate that many people buy a single article at a time at a listed price and that the knowledge of how to make change is all that is needed for completing the transaction. The clerk often does not make use of this knowledge, for he simply makes out a bill and the purchaser pays the cashier. The consumer, however, if he is to protect his own interests, ought to make use of his knowledge of making change in checking the amount given by the cashier.

The lack of the need for arithmetic is again manifest when it is stated that in the hardware store adding machines and comptometers are available for the clerks if the nature of the computations makes these devices desirable. However, in making the ordinary sales these devices are not used. The clerk in the department store has only to set an indicator at the proper selling price, draw the desired amount of goods through the measuring device, read the total sum calculated mechanically as the material is drawn through, and record the total on the bill of sale. In the grocery store extensive use of the computing scale reduces the use of arithmetic to a minimum, i.e., to adding the prices paid for the itemized articles and possibly making the necessary change.

The use of these devices has reduced very materially the amount of arithmetic needed by the clerk but has increased the need for skill in arithmetic on the part of the consuming public. In calculating by the old-fashioned method there was opportunity for the customer to check the figures of the clerk; but when computing devices are used, the cost price is merely stated and if any checking is done to see whether the device is properly set or whether the cost price is properly read it must be done by the consumer himself. Usually this computation must be done mentally and represents a quick judgment in round numbers concerning the accuracy of the transaction. This need for mental arithmetic becomes more emphatic when it is stated that in making this investigation one

grocery store was consulted in which almost all calculations were mental. No bills of sale were made out, and no figuring with pencil was done save where so many articles were purchased that it was difficult to keep them in mind. Where this practice is followed it behooves both salesman and customer to be alert in mental arithmetic.

Another interesting point brought out by this investigation is the absence of the use of decimals except in connection with United States money. Since all these problems are connected with buying and selling, it is natural for United States money to be involved, and the intimate relationship between it and decimals ought to be significant to teachers. The relationship existing between percentage and United States money is equally significant.

CONCLUSIONS

The following statements seem to be warranted from this investigation:

1. The amount of arithmetic actually used in the selling of the goods as listed on the bills of sale is very small. The problems most commonly met in the four fundamental operations consist of adding three-place or four-place numbers having two, three, or four addends; subtracting numbers with four places or less in the minuend; multiplying a three-place number by a one-place or two-place number; and dividing a three-place number by a two-place or three-place number. The most common fractions are halves, fourths, twelfths, and sixths.

2. Multiplication and addition are used much more than division and subtraction. Subtraction as such is very little used except in making change, and then the additive method is commonly used. Many problems in multiplication involving the use of the more frequently used fractions suggest the need for much practice in our schools in multiplying by mixed numbers.

3. The use of measuring and computation devices has reduced the amount of arithmetic used in selling goods, but it has created a demand for a superior knowledge of arithmetic on the part of the consumer in order to provide the ability for checking the accuracy of manipulating the devices. This fact, together with

the fact that some stores utilize mental arithmetic almost exclusively, creates a demand for much mental arithmetic in the schools. This should include drill on the fundamental operations and also in forming quick judgments concerning the accuracy or inaccuracy of probable answers to buying or selling situations of ordinary life.

4. Denominate numbers as such are not used in the buying or selling of goods. Goods are sold in appropriate units and fractional parts thereof, but no attempt is made to reduce from one denomination to another. Since an individual in meeting the complex activities of life may use various units of denomination (e.g., inch, foot, and yard), it seems that there is some justification for a small amount of instruction in denominate numbers even though the actual reduction is not made in business life.

5. Decimals and percentage are always used in connection with United States money, and it would seem folly to isolate them in instruction in the elementary school.

6. It is the usual practice in some stores to price goods at so much per article or per group of articles. In computing the cost of a considerable number of articles, unless the number is an even multiple of the group, the group price is used as a basis for part of the costs and the price per article for the remainder. It would be well for the schools to take cognizance of this fact and to give practice in solving problems of this kind.

7. Since measuring and computing devices are used so extensively and since the children who are to be the consuming public must deal directly or indirectly with them, it seems reasonable to suggest that the school should provide information concerning them and their use. Demonstrations can be given at the school, or the teacher and pupils can visit a store where the devices are used. The aim of such instruction should be to make the children intelligent concerning the devices rather than to give them skill in manipulating them.

8. Since the amount of arithmetic used in the selling of goods is so small the charge often reputed to business men that the children trained in the schools of today are woefully deficient in arithmetic seems incredible. If the children actually are deficient, it

seems that factors other than the ability of the school to impart such training are involved.

9. From the facts disclosed by this investigation it is evident that the school is emphasizing much arithmetic that is unessential in meeting the situations confronted by the salesman and the consuming public. It seems wise to urge the elimination of the unessentials and a concentration upon the types of problems here described. However, this process of elimination must not take place too suddenly, for investigations involving other phases of these same lines of business or other lines of business may show variations in the types of problems encountered. Additional investigations must corroborate and supplement the findings of this study. Until these investigations have been made, the present results must be considered as a suggestive basis upon which to construct a course of study in arithmetic.